

RESPONSE

To: Commissioner of the Patent Office

1. Indication of International Application: PCT/JP2005/003129

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5. Contents of Response

(1) Since the statement denied the inventive step of the invention defined in Claims 1 to 3 of the present application, it is refuted as follows. Among Claims 1 to 3, Claim 1 and Claim 2 are amended as in an Amendment filed with this Response. Since a new limitation is added to Claim 1, the corresponding limitation was deleted from Claim 2. Claim 3 is the same as originally filed.

(2) The invention defined in Claim 1 of the present application relates to an electromagnetic fuel injection valve, in which a valve member is contained in a valve housing comprising a magnetic cylinder coaxially coupled at a front end thereof to a valve seat member having a valve seat, the valve member being spring-biased in a direction in which the valve member is seated on the valve seat; a non-magnetic cylinder serving as a member different from the magnetic cylinder is coaxially coupled at a front end thereof to a rear end of the magnetic cylinder to surround a portion of a movable core which is coaxially connected to the valve member with a rear end face thereof serving as a movable attraction face; and a front portion of a stationary core having a front end face serving as a stationary attraction face is fitted into and fixed in a rear portion of the non-magnetic cylinder, so that the stationary attraction face is opposed to the movable attraction face, and is, in particular, characterized in the following arrangement.

“the front portion of the stationary core is fitted and fixed in the non-magnetic cylinder so as to be in close contact with an inner surface of an intermediate portion of the non-magnetic cylinder in a region corresponding to the stationary attraction face, and in the inner peripheral surface of the non-magnetic cylinder, an annular recess having a flat portion flush connected to the stationary attraction face is provided to form an annular chamber between the annular recess and an outer periphery of the rear portion of the movable core, and in the inner peripheral surface of said non-

magnetic cylinder, a center bore having an inside diameter larger than an outside diameter of the stationary attraction face is further provided at a location in front of the annular recess, a guide bore is provided in an inner periphery of the magnetic cylinder and flush connected to the center bore of the non-magnetic cylinder, and the annular chamber is formed by continuously connecting the flat portion of said annular recess and the center bore and guide bore by means of an inclined surface"

With the above arrangement, the outer periphery of the stationary attraction face at the front end of the stationary core is flush connected to the flat portion of the annular recess provided in the inner periphery of the non-magnetic cylinder into which the stationary core is fitted and fixed. Therefore, as compared with a stationary core having a chamfer provided around its outer periphery at its front end, it is possible to set the area of the stationary attraction face at a large value to the utmost to provide an increase in attraction force. In addition, an annular groove is not formed between the stationary core and the non-magnetic cylinder, but the annular chamber is defined between the movable core and the non-magnetic cylinder to surround the outer periphery of the rear portion of the movable core. Therefore, even if chips and a magnetic powder are produced, it is possible to prevent inconvenience that they may enter the conventional groove, and they can be fluidized and prevented from being accumulated and deposited. More specifically, the annular recess forming the annular chamber between the rear outer periphery of the movable core and the annular recess is to be formed at the inner peripheral surface of the non-magnetic cylinder serving as a member different from the magnetic cylinder, and therefore, even if the annular recess is formed, the magnetic characteristic of the structure surrounding this annular recess is not changed. Further, the annular recess is formed to have a flat portion flush connected to the stationary attraction face of the stationary core, and the center bore having an inside

diameter larger than an outside diameter of the stationary attraction face is provided in an inner periphery of the non-magnetic cylinder at a location in front of the annular recess, and on the other hand, the guide bore is provided in the inner periphery of the magnetic cylinder coaxially connected at the front end and the rear end of the non-magnetic cylinder and is flush connected to the center bore of the non-magnetic cylinder, and the annular chamber is formed by continuously connecting the flat portion of the annular recess and the center bore and guide bore by means of an inclined surface. Therefore, the above-described chips and magnetic powder are fluidized on smooth continuous surfaces including the inclined surface of the annular recess formed in the non-magnetic cylinder and can extremely effectively be prevented from being accumulated and deposited there.

(3) On the contrary, Document 1, JP7-279794 cited for denying the inventive step of Claim 1 teaches an apparatus including a fuel injection valve different from the present invention in the basic arrangement, does not mention the arrangement in which the problems to be solved by the present invention exist, and does not at all teach nor suggest the distinguishing arrangement in which the function and effects brought about by the present invention can be provided.

In the statement, it is stated that "a non-magnetic portion 1c" in Document 1 corresponds to "a non-magnetic cylinder (26)" in the present invention, and "an extended portion 1a" in Document 1 corresponds to "a magnetic cylinder (9)" in the present invention. However, Claim 1 amended this time apparently defines "a non-magnetic cylinder (26)" as a member different from "a magnetic cylinder (9)" and this is an arrangement indispensable to obtaining the stable magnetic characteristic when compared with the arrangement taught by Document 1.

In the case of Document 1, a non-magnetic portion 1c is formed integrally with a core 1 exhibiting magnetic force for attracting an armature 2 (see par. [0008] and

[0009] in Document 1), and in particular, the non-magnetic portion 1c (a groove 10) has the structure that is subjected to non-magnetic treatment over its entire wall thickness. When a portion of the core 1 formed as a magnetic member of a single member is subjected to non-magnetic treatment, as described above, dispersion occurs in the non-magnetic area, and accordingly, the magnetic characteristic varies over the area and the yield is apt to deteriorate, as a result. In addition, if magnetic portion remains in the groove 10, chips and magnetic powder are apt to be accumulated and deposited thereon. Further, the groove 10 forms an angular U-shape in section, as shown in Figs. 2 and 3, and has such structure that if chips and magnetic powder enter the groove 10, they are hardly fluidized and easily accumulated. The form of the groove 10 apparently provides low ability of fluidization of chips and magnetic powder.

Document 2, JP7-189852 cited this time does not teach nor suggest the portion lacking in the above-described Document 1, especially, such structural characteristic as well as function and effects inherent to the present invention that the non-magnetic cylinder is intentionally formed as a member different from the magnetic cylinder, and the annular recess forming the annular chamber is of a unique form, thereby preventing chips and magnetic powder from being accumulated and deposited thereon. Therefore, the invention defined in Claim 1 apparently has inventive step.

(4) Claim 2 and Claim 3 depend on the above described Claim 1, and therefore have inventive step, thus patentability like Claim 1 as a matter of course.

(5) As described above, the inventions defined in amended Claim 1 and its dependent claims, Claim 2 and Claim 3 of the present application possess novelty and inventive step over Documents cited this time, and should be granted a patent.